

MODULE SIX- SIX SIGMA QUALITY PROCESS

LESSON ASSIGNMENT

Objectives:

- To introduce the participant to the fundamental concepts and components of Six Sigma and process capability indices.
- To familiarize the participant with the concepts of Cp, Cpk.
- To familiarize the participant with basic charting techniques

Desired Learning Outcomes: The student should be able to:

- Understand the benefits of controlling process variation.
- Understand the key concepts of Six Sigma, Cp, and Cpk.
- Describe the methodology of achieving six sigma processes

Chapter 6

WORKBOOK FOR MODULE SIX

SIX SIGMA QUALITY PROCESS

Mr. Ron Randall

Texas Instruments

STAGE ONE (Before the Video)

Before viewing the video tape there is an article provided as a read ahead for this module on the subject of Six Sigma. The Article "Six Sigma in Product Development", is co-authored by Mr. Rich Karm and Mr. Ron Randall. Mr. Randall is the presenter in the video tape. Please read the article with these points in mind, and answer the following questions.

The objective of "Six Sigma" as a philosophy is to extend the statistical process control methodology from the factory floor to the designer's drafting table. "A major lift can be achieved by improving the quality of designs, so as to be more compatible with the manufacturing process." The chief criticism that one hears from the scientific community is, "these methods are quality assurance methods, they're application resides on the shop floor as a measurement of machine work. There is no application to the scientific world where the primary task is to advance technology." The principle counter argument and the reason for introducing six sigma into manufacturing is very simply stated, "if the technology can not be fabricated or inserted into an existing product, then the technology is useless." In today's resource environment there is an extension of that premise. If the technology can not be fabricated or inserted into a product "AFFORDABLY."

Q1. What is six sigma?

Q2. What is six sigma design?

Q3. What is the arithmetic mean of the following array of test scores of ten students?

Mark 71, Sue 72, Joan 82, Pete 82, Ann 83, Fred 84, Mary 85, Jack 85, Joy 85, Joe 97

Q4. What is the median of this group?

Q5. What is the standard deviation of the grouping?

Q6. Who is the curve buster? By how many Sigma's?

Start your review of the video
STAGE TWO (End of Video)

Q7. In terms of attribute data, how many defects does six sigma represent?

Q8. What is meant by "benchmarking"?

Q9. What is a basic reason for defect creation?

Q10. How do you define a defect?

Q11. What is meant by DPMO?

Q12. What is process "capability" by definition ?

Q13. Write the definition of Cp in terms of product and process.

Q14. What is the tendency of a process to shift before the operator becomes aware of the shift?

Q15. Write the definition of Cpk in terms of product and process.

EXERCISE

In your performance of the exercise, please perform the sample techniques and take measurements in each of the three specifications. Take forty observations of each characteristic. Build the histograms for each by adding up how many marks are in each one-inch section and then graphing the amounts

to show the distribution. Calculations for C_p and C_{pk} for each of the characteristics should also be accomplished. Follow the instructions in the exercise module.

Hardness

You should throw a pencil or marker from ten feet away from a grid (x-y graph or a large flip chart paper that is marked in one inch vertical lines increments. The objective is to hit the center line.

Reflectivity

You should drop a pencil from waist height to a paper marked with an x-y grid. The objective is to hit the center line every time. Take forty samples (drops). Calculate the C_p/C_{pk} for this characteristic.

Yield Strength

Roll a tube of paper, fasten with scotch tape. Use this tube as an “aiming device” to add more control precision to the process. Position the tube at least one foot above the surface of the paper. The objective is to hit the center line. Take forty samples (drops) Calculate the C_p C_{pk} for this characteristic.

Compare the C_{pk} of each of the characteristics. Which one would you, as the program manager of this project, add resources to improve

ANSWERS for Module Six

SIX SIGMA QUALITY PROCESS

Q1. What is six sigma?

A1. Six sigma is a statistical yardstick for quality, a stretch goal, and a methodology for continuous improvement.

Q2. What is six sigma design?

A2. Six sigma Design is the application of statistical techniques to analyze and optimize the inherent system design margins. The objective is a design which can be built error free.

Q3. What is the arithmetic mean of the following array of test scores of ten students?

Mark 71, Sue 72, Joan 82, Pete 82, Ann 83, Fred 84, Mary 85, Jack 85, Joy 85, Joe 97

A3. 82.6

Q4. What is the median of this group?

A4. 83.5

Q5. What is the standard deviation of the grouping?

A5. 7.26

Q6. Who is the curve buster? By how many Sigma's?

A6. Joe by 2 sigma

Q7. In terms of attribute data, how many defects does six sigma represent?

A7. 3.4 defects per million.

Q8. What is meant by “benchmarking”?

A8. Benchmarking refers to a comparison of a product or process. The benchmark serves as a standard by which others are measured.

Q9. What is a basic reason for defect creation?

A9. Defects occur when Capability does not meet the Requirement.

Q10. How do you define a defect?

A10. You should always start defining or listing defect characteristics with the customer. Look at the metrics cascade for benchmarking, it starts with the customer.

Q11. What is meant by DPMO?

A11. Defects per Million Opportunities relates to the number of “things” that must be right for the product or process to meet all the requirements. The million opportunities scale then brings the relationship to sigma levels for comparison.

Q12. What is process “capability” by definition ?

A12 Plus or minus 3 sigma.

Q13. Write the definition of Cp in terms of product and process.

A13. $\frac{\text{Product requirement}}{\text{Process capability}}$ or $\frac{\text{USL} - \text{LSL}}{+ 3}$ Or $\frac{\text{Car Width}}{\text{Road Width}}$

Q14. What is the tendency of a process to shift before the operator becomes aware of the shift?

A14. Processes will nominally tend to shift 1.5 sigma from the mean before awareness of the shift takes place.

Q15. Write the definition of Cpk in terms of product and process.

A15 $\frac{\bar{x} - \text{nearest spec limit}}{\sigma} = Cpk$